PHYTOTOXICOLOGY SECTION INVESTIGATIONS IN THE VICINITY OF BRAMPTON BRICK LTD., 514 MAIN ST. N., BRAMPTON, 1989 AND BRAMPTON BRICK LTD., 225 WANLESS DR., BRAMPTON, 1987 AND 1989

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IN THE VICINITY OF

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AND BRAMPTON BRICK LTD., 225 WANLESS DR., BRAMPTON, 1987 AND 1989

Report prepared by:

Air Resources Branch
Ontario Ministry of the Environment

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Section 1: Background

Brampton Brick Limited is a major Canadian producer of clay brick. Brampton Brick has produced clay brick at 514 Main St. N. in Brampton since 1949. This brickwork had an annual capacity of 150 million bricks. Gaseous hydrogen fluoride (HF) is emitted to atmosphere from the brick kilns during the firing of the bricks. In December 1988 one kiln at the 514 Main St. N. plant was shut down, reducing emissions by 50 percent. The last kiln at 514 Main St. N. was shut down in the fall of 1989. All operations were subsequently transferred to the new brickworks at 225 Wanless Dr.

The Phytotoxicology Section, Air Resources Branch, Ministry of the Environment has conducted vegetation assessment surveys in the vicinity of the Brampton Brick brickworks regularly since 1973, with the exception of 1978 and 1988 (see references 1 to 13). Each year, near the middle of September, sensitive vegetation was examined for fluoride induced injury and samples of tree foliage were collected for fluoride analysis. From 1973 to 1981 trace amounts of typical fluoride injury were observed on leaves of sensitive tree species at sites within 300 meters of the brickwork's property boundary. From 1982 to 1986, no visible fluoride injury has been observed on fluoride sensitive vegetation. Fluoride injury was observed on Manitoba maple at one location in 1987.

In 1987, Brampton Brick proposed a new 100 acre plant at 225 Wanless Dr., approximately three kilometers north of the existing plant, near the community of Snelgrove in Brampton. The plant would have an initial annual capacity of 120 million bricks with an ultimate capacity of 200 million bricks. In April, 1988 the Ministry of the Environment issued a Certificate of Approval for the installation of a dry limestone scrubber for the new brick manufacturing plant. The new plant started operation 1988 but did not become fully operational until the old brickworks at 514 Main St. N. was shut down in 1989.

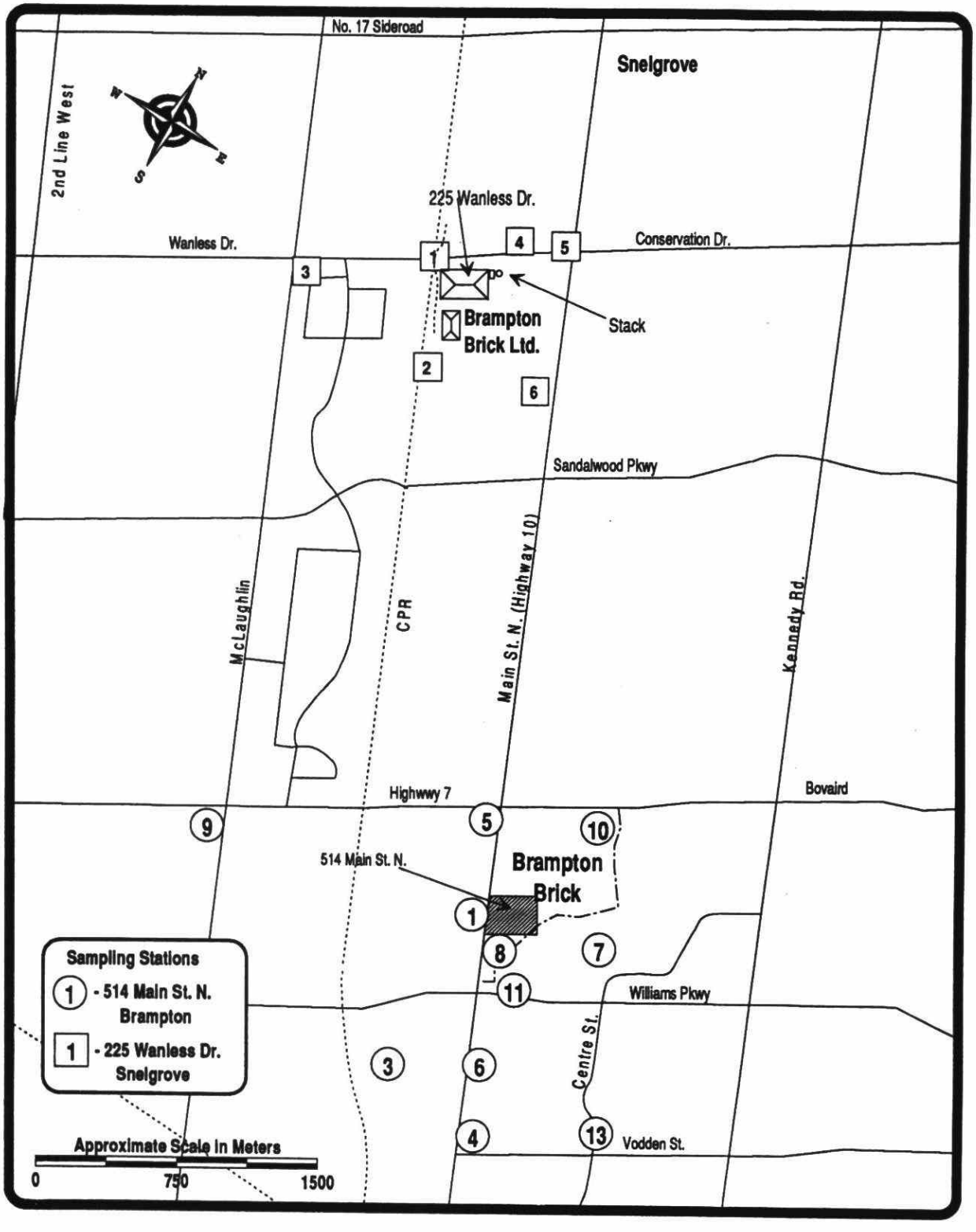
Section 2: Methods

A pre-operational vegetation assessment survey was conducted by the Phytotoxicology Section, Air Resources Branch, Ministry of the Environment in the vicinity of the brickworks at 225 Wanless Dr. on November 4, 1987. Duplicate grass samples were collected at 5 locations within one kilometer of the brickworks. Grass was collected as there were not sufficient numbers of suitable trees to sample in the vicinity of the plant. The first operational survey at the new brickworks was conducted on October 24, 1989. Duplicate grass samples were collected from the same five locations as the pre-operation survey and at one additional location (see Figure 1).

Duplicate tree foliage samples were collected at 11 locations within two kilometers of the old brickworks at 514 Main St. N. on September 28, 1989. The sampling locations were the same as had been utilized for all of the previous surveys (see Figure 1).

The samples in all three surveys were collected using standard Phytotoxicology sampling techniques (14). All samples were delivered to the Phytotoxicology Section sample processing laboratory in Toronto where they were dried and ground before being submitted to the Inorganic Trace Contaminants Section, Laboratory Services Branch for chemical analysis. The samples were analysed for total fluoride.

Figure 1: Sketch Map Showing the Approximate Locations of the Sampling Locations in the Vicinity of the Brampton Brick Ltd. Brickworks at 514 Main St. N. and 225 Wanless Dr. in Brampton.



Section 3: Results

No fluoride related vegetation injury was observed in the vicinity of the brickworks either at 514 Main St. N. or 225 Wanless Dr., Brampton at the time of the surveys.

The results for the September 28, 1989 survey around the 514 Main St. N. brickworks are given in Table 1. Results from the 1983 to 1987 surveys at this location are also included for comparison purposes. The results for the November 4, 1987 and the October 24, 1989 surveys around the 225 Wanless Dr. brickworks are given in Table 2. The results are expressed as µg/g dry weight and are the mean of the duplicate samples collected at each site. Values that exceed the Upper Limit of Normal (ULN - see Appendix B and/or reference 15) are indicated in bold italic type.

Table 1: Results of Fluoride Analysis of Tree Foliage Collected in the Vicinity of Brampton Brick Ltd., 514 Main St. N. Brampton on September 28, 1989 and 1983 to 1987.

Station Number	Tree Species	Concentration* 1983	1984	1985	1986	1987	1989
1	Silver Maple	***47***	***101***	***124***	***105***	***405***	***44***
3	Manitoba Maple	9	24	32	21	19	12
4	Manitoba Maple	6	24	13	7	9	4
5	Manitoba Maple	8	11	15	12	28	10
6	Manitoba Maple	10	***40***	33	15	***41***	18
7	Sugar Maple	20	***40***	***44***	25	***56***	8
8	Manitoba Maple	***88***	***387***	***291***	***310***	***450***	***150***
9	White Ash	7	8	6	5	13	5
10	Manitoba Maple	7	13	10	10	17	8
11	Manitoba Maple	***116***	***151***	***213***	***195***	***375***	***68***
13	Manitoba Maple	11	21	15	22	29	10
Urban ULN**		35	35	35	35	35	35

* µg/g Dry Weight, mean of duplicate or triplicate samples
** ULN explained in Appendix B and reference 15

Table 2: Results of Fluoride Analysis of Grass Collected in the Vicinity of Brampton Brick Ltd., 225 Wanless Dr., Brampton on October 24, 1989 and the 1987 Pre-operational Survey.

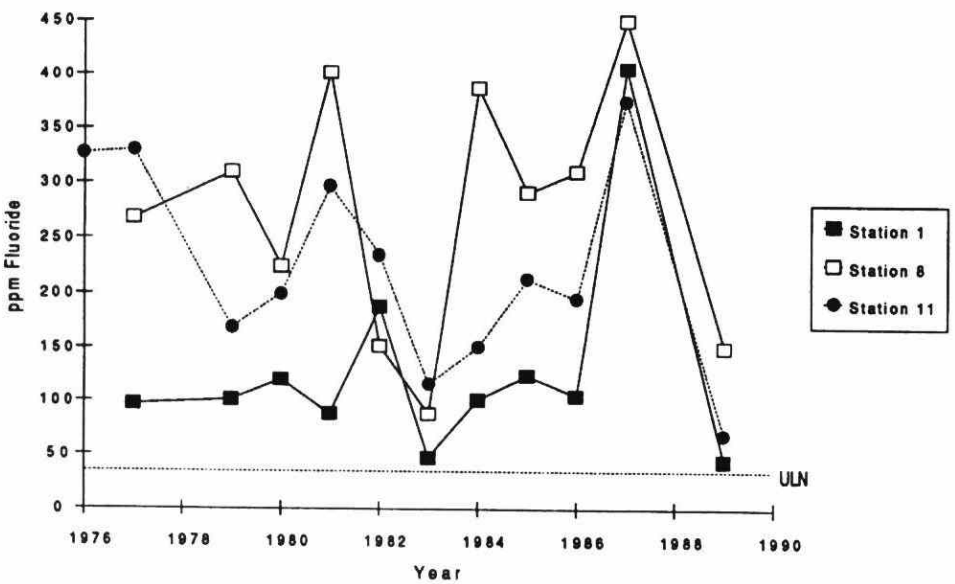
Station	Concentration* 1987	1989
1	6	10
2	5	11
3	6	11
4	5	***19***
5	6	12
6	ns	***15***
Rural ULN**	12	12

* µg/g Dry Weight, mean of duplicate or triplicate samples
** ULN explained in Appendix B and reference 15, ns - not sampled

Section 4: Discussion

The fluoride levels in maple foliage in the vicinity of the Brampton Brick brickworks at 514 Main St. N., Brampton decreased significantly in 1989 when compared to 1987. While the fluoride levels decreased at all stations, the largest decreases were observed closest to the brickworks at stations 1, 8 and 11. The foliar fluoride levels in 1989 were comparable to those detected in 1983. These two sampling years recorded the lowest fluoride concentrations in the 11 year sampling history of this source (see Figure 2). While the decrease was significant, the Urban Upper Limit of Normal (ULN) guideline for fluoride in vegetation was exceeded at the three closest locations. The observed decrease in fluoride levels in 1989 is what would be expected considering that one of the two kilns at this location had not been operating since 1988.

Figure 2: Results of Fluoride in Maple Foliage at Sampling Station 1, 8 and 11 Near Brampton Brick, 514 Main St. N., Brampton for 1976 to 1989



Fluoride levels in grass collected in the vicinity of the Brampton Brick plant at 225 Wanless Dr., Brampton in 1989 showed a significant increase over the 1987 pre-operational levels at all sampling locations. Although the fluoride levels in grass were well below the level of concern with respect to the health of grazing animals, the Rural ULN guideline for fluoride in grass (12 ppm) was exceeded at stations 4 and 6. The fluoride levels at the other locations were just below the rural ULN. The Rural ULN guideline was used as there currently is no Urban ULN for fluoride in grass, and this area, while being developed for commercial and industrial land use, was recently rural. There is still farming being carried out to the north and west of the brickwork.

These results indicate that the new plant is a source of fluoride emissions. The full impact of the new brickwork would not be reflected in the 1989 results, as the plant experienced start up problems and was not running at full capacity during the 1989 growing season.

As pre-operational levels were exceeded at all sampling locations, more stations farther from the source will be added to the survey in 1990. In addition, maple foliage will be collected where possible.

Section 5: Summary

While the fluoride levels in maple foliage decreased significantly in 1989, as the result of the shut down of one of the two brick kilns at the Brampton Brick Ltd. brickworks at 514 Main St. N., Brampton, the Upper Limit of Normal for fluoride in vegetation was still exceeded at the three stations closest to the plant. No fluoride related vegetation injury was observed around the brickworks.

The fluoride levels in grass in the vicinity of the Brampton Brick brickworks at 225 Wanless Dr., Brampton were higher in 1989 than the 1987 pre-operational levels. Although the fluoride levels in grass were well below the level of concern with respect to the health of grazing animals, the rural ULN guidelines were exceeded at two of the six stations while the fluoride concentrations at the remaining four locations were also elevated above the pre-operational levels. No fluoride related vegetation injury was observed around the brickworks.

Appendix A: References

(1) Ontario Ministry of the Environment. 1988. Phytotoxicology Assessment Survey Investigation in the vicinity of Brampton Brick Limited, 514 Main Street North, Brampton, Ontario on September 21 and 22, 1987. ARB-119-88-Phyto.

(2) Ontario Ministry of the Environment. 1987. Phytotoxicology Assessment Survey Investigation in the vicinity of Brampton Brick Limited, 514 Main Street North, Brampton, September 1986. ARB-119-87-Phyto.

(3) Ontario Ministry of the Environment. 1986. Phytotoxicology Assessment of Vegetation for Fluoride Content and Injury around Brampton Brick, on September 20, 1985. ARB-07-86-Phyto.

(4) Ontario Ministry of the Environment. 1985. Vegetation Surveillance Studies in the vicinity of Brampton Brick 1984. ARB-38-85-Phyto.

(5) Ontario Ministry of the Environment. 1984. Vegetation Surveillance Studies in the Vicinity of Brampton Brick, 1983. ARB-64-84-Phyto.

(6) Ontario Ministry of the Environment. 1983. Vegetation Surviellance Studies in the Vicinity of Brampton Brick, 1982. ARB-50-83-Phyto.

(7) Ontario Ministry of the Environment. 1982. Vegetation Surveillance Studies in the Vicinity of Brampton Brick, 1981.

(8) Ontario Ministry of the Environment. 1981. Phytotoxicology Investigations in the Vicinity of Brampton, Brick Ltd., Brampton, Ontario, during the 1980 Growing Season.

(9) Ontario Ministry of the Environment. 1980. Results of the Vegetation Surveillance around Brampton Brick, 514 Main St. N., Brampton, on July 9 and September 20, 1979.

(10) Ontario Ministry of the Environment. 1976. Phytotoxicology Section Investigation Final Report Brampton Brick, 514 Main St. N., Brampton, July 5 and September 13, 1976.

(11) Ontario Ministry of the Environment. 1975. Phytotoxicology Section Investigation Final Report Brampton Brick, 514 Main St. N., Brampton, July 11 and September 4, 1975.

(12) Ontario Ministry of the Environment. 1975. Phytotoxicology Section Investigation Final Report Brampton Brick, 514 Main St. N., Brampton, October 3, 1974.

(13) Ontario Ministry of the Environment. 1973. Vegetation Surveillance - Brampton Brick.

(14) Ontario Ministry of the Environment, 1988. Field Investigation Manual. Phytotoxicology Section - Air Resources Branch; Technical Support Sections - NE and NW Regions

(15) Ontario Ministry of the Environment, 1989. Ontario Ministry of the Environment "Upper Limit of Normal" Contaminant Guidelines for Phytotoxicology Samples. Phytotoxicology Section - Air Resources Branch ARB-138-88-Phyto. ISBN: 0-7729-5143-8

Appendix B: Derivation and Significance of MOE "Upper Limits of Normal" Contaminant Guidelines

The MOE "upper limits of normal" contaminant guidelines essentially represent the expected maximum concentration of contaminants in surface soil (non-agricultural), foliage (tree and shrub), grass, moss bags and or snow from areas of Ontario not subject to the influence of point sources of emissions. "Urban" guidelines are based upon samples collected from centers of minimum 10,000 population. "Rural" guidelines are based upon samples collected from non-built-up areas. Samples were collected by MOE personnel using standard sampling techniques (ref: Ministry of the Environment, 1983. Field Investigation Manual. Phytotoxicology Section - Air Resources Branch: Technical Support Sections - NE and NW Regions). Chemical analyses were performed by the MOE Laboratory Services Branch.

The guidelines were calculated by taking the arithmetic mean of available analytical data and adding three standard deviations of the mean. For those distributions that are "normal", 99% of all contaminant levels in samples from "background" locations (i.e. not affected by point sources nor agricultural activities) will lie below these upper limits of normal. For those distributions that are non-normal, the calculated upper limits of normal will not actually equal the 99th percentile, but nevertheless they lie within the observed upper range of MOE results for Ontario samples.

Due to the large variability in element concentrations which may be present across Ontario, even in background data, control samples should always be collected. This is particularly important for soils, which may show large regional variations in element composition due to difference in parent material. Species of vegetation which naturally accumulate high levels of an element also may be encountered.

It is stressed that these guidelines do not represent maximum desirable or allowable levels of contaminants. Rather, they serve as levels which, if exceeded, would prompt further investigation on a case by case basis to determine the significance, if any, of the above normal concentration(s). Concentrations which exceed the guidelines are not necessarily toxic to plants, animals or man. Concentrations which are below the guidelines are not known to be toxic.